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### **High pre-operative expectations precede both unfulfilled expectations and clinical improvement after total hip and total knee replacement**

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# High Pre-Operative Expectations Precede Both Unfulfilled Expectations and Clinical Improvement After Total Hip and Total Knee Replacement

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## ABSTRACT

**Background:** This prospective study aimed to examine whether patients' and physicians' outcome expectations were related to subjective (ie, fulfillment of expectations) and objective outcomes (ie, change in pain and function) in hip and knee arthroplasty patients up to 6 months post-surgery.

**Methods:** Patients' (N = 395) and physicians' outcome expectations were examined 1 week post-consultation. Patients' post-operative functional status and the extent of fulfillment of expectations were examined 5 weeks, 3 months, and 6 months post-surgery. Patients and physicians completed the Hospital for Special Surgery Hip/Knee Replacement (Fulfillment) Expectations Survey. Patients completed the Hip/Knee injury and Osteoarthritis Outcome Score. Linear regression analyses were performed to examine the relationship between physicians' expectations and patients' change in pain and function and extent of fulfillment of expectations, and a possible mediated effect of patients' pre-operative expectations.

**Results:** Patients' high expectations were consistently associated with better objective outcomes (ie, change in pain and function). Yet, high expectations in patients were also negatively related to subjective outcomes (ie, the extent of fulfillment of expectations). Physicians' expectations were only positively associated with objective improvement in knee patients, and not in hip patients. Additionally, knee patients' expectations partly mediated the relationship between physicians' expectations and change in pain and function, 6 months post-surgery.

**Conclusion:** Although patients' high expectations were associated with better objective outcomes, improvement was still less than patients expected. Thus, patients often have too high expectations of outcomes of surgery. In addition, physicians were able to influence patients' expectations and to change experienced knee patients' outcomes.

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Outcomes resulting from total hip arthroplasty (THA) and total knee arthroplasty (TKA) are dependent on the clinical effects resulting from the act of performing surgery [1–3]. However, outcomes after surgery that are not attributable to this genuine effect of treatment (eg, placebo effects) are common in treatment for conditions with high levels of pain, like osteoarthritis [1–6]. Patients' expectations for outcomes of THA and TKA could potentially influence these non-specific treatment effects, as they are found to relate to more successful recovery and better general health outcomes [2,3,7–12].

Nevertheless, the literature is inconsistent regarding this relationship. Patients' expectations are not always significantly related to treatment outcomes [13]. Therefore, some studies suggested that patients' expectations could mediate the relationship between physicians' expectations and treatment outcomes [1,10,14,15]. Physicians who communicate their expectations could thereby influence patients' expectations, which could relate to better outcomes [1,13,15–20]. This is in accordance with the notion that expectations are not fixed; they can change during medical consultation [21,22].

Non-specific treatment effects, like the placebo effect, could then be complemented with the physicians' optimism (ie, the curabo effect) [18]. Consequently, this could relate to advantageous treatment outcomes [18]. If this is true, then physicians could subsequently play an important part in the development and modification of patients' expectations. However, to the best of our knowledge, this mediation effect is not yet studied. Moreover, numerous studies found that physicians' expectations are not always significantly associated with treatment outcomes [10,15,18,23,24]. For example, physicians generally are worse in predicting outcomes for TKA patients, who in general show less fulfilled expectations, lower improvement rates, longer duration of improvement, and lower level of satisfaction after surgery, than THA patients [15,18,25–31].

It was hypothesized that physicians' expectations relate to patients' expectations and that, as a result, patients' expectations could be associated with better treatment outcomes. Therefore, the primary aim of this prospective study is to examine the relationship between physicians' expectations and both hip and knee patients' expectations and our primary outcome measures; the subjective outcomes (ie, extent of fulfillment in expectations) and objective outcomes (ie, change in pain and function) of patients, up to 6 months post-surgery. Furthermore, a possible mediation effect of patients' expectations on the relationship between physicians' expectations and outcome was examined.

## Materials and Methods

This study is part of the EXPECT study, a prospective cohort study in patients with osteoarthritis. It is conducted at the Department of Orthopedics of the Elisabeth-TweeSteden Hospital, Tilburg, the Netherlands. This study was conducted according to the principles of the Declaration of Helsinki (version 8, 2013) and the Medical Research Involving Human Subject Act (WMO). It was approved by the local Medical Ethical Review Board. Data for this paper were obtained between November 2016 and May 2019.

### Patients

All patients with symptoms of osteoarthritis were consecutively included at first encounter with the physician. Patients were excluded when they were unable to understand or complete the questionnaires (eg, when having insufficient knowledge of the Dutch language or when suffering from severe cognitive impairment [eg, dementia]). For this study, only a subset of data was used,

namely, only data of patients who received surgical treatment for their osteoarthritis (ie, TKA or THA patients).

### Procedure

All included patients gave written informed consent and received a questionnaire 1 week after their medical consultation. Data from 3 additional time points were used in this paper: 5 weeks post-surgery, 3 months post-surgery, and 6 months post-surgery. Six months post-surgery is used as the final time point within this study, as it is thought to be the point in time at which patients, on average, have achieved most clinically important improvement in pain and function [32–37]. Physicians were asked to complete a questionnaire directly after consultation.

### Measures

#### Expectations

The Hospital for Special Surgery Hip Replacement Expectations Survey (HSS-HRES) [38] or the Hospital for Special Surgery Knee Replacement Expectations Survey (HSS-KRES) [39] was used to examine pre-operative expectations 1 week post-consultation. Patients were asked how much improvement they expected in respectively 18 or 19 domains. Answers could range from 0 ("this question does not apply") to 5 ("complete improvement or back to normal"). Physicians completed an adapted version [40] of the HSS-HRES or HSS-KRES, with the modification as follows: "How much relief or improvement seems realistic to you in the following areas as a result of hip/knee replacement surgery for this specific patient?" Patients indicated on the Hospital for Special Surgery Hip Replacement Fulfillment Expectations Survey (HSS-HRFES) [38] or the Hospital for Special Surgery Knee Replacement Fulfillment Expectations Survey (HSS-KRFES) [39] how much improvement they experienced 5 weeks, 3 months, and 6 months post-surgery. Scores were transformed by dividing the score of each patient by the maximum score possible [38,39]. The resulting value could range from 0% to 100%. Higher values indicate more and higher level of (fulfilled) expectations. The Dutch version of this questionnaire showed good test-retest reliability and good internal consistency [41].

#### Functional Status

The Hip injury and Osteoarthritis Outcome Score [42] or the Knee injury and Osteoarthritis Outcome Score [43] were used to assess treatment outcomes 5 weeks post-surgery, 3 months post-surgery, and 6 months post-surgery. The questionnaire was divided into 2 subscales: pain and function [44]. Participants had to indicate on a 5-point Likert scale whether they experienced the problems presented during the last week. Total scores were derived by summing the answers of each scale. Scores could range from respectively 0–20 (pain) and 0–68 (function). Scores were transformed on a scale of 0%–100%, in which lower scores indicate more extreme problems. The scales have good psychometric properties [42,43].

#### Statistical Analysis

Statistical analyses were performed using IBM SPSS Statistics version 24. A .05 level of significance was applied to evaluate statistical significance. Hip and knee patients' data were compared in our analyses, as outcomes proved different for these 2 patient groups [25–31].

Changes in pain and function scores over time were calculated by subtracting baseline scores (1 week post-consultation) from scores 5 weeks post-surgery, 3 months post-surgery, and 6 months

**Table 1**  
Sociodemographic Characteristics of Hip and Knee Patients.

Mean (SD)	Combined (N = 396)	Hip (N = 205)	Knee (N = 190)	Hip vs Knee	
				$t/\chi^2$	P Value
Women, n (%)	236 (59.6)	115 (56.1)	121 (63.7)	5.4	.25
Age	69.8 (7.9)	70.4 (8.0)	69.2 (7.8)	1.4	.15
Employed for monetary reimbursement: yes (%)	63 (21.2)	32 (19.8)	31 (23.0)	2.1	.56
Conducting sports on regular basis: yes (%)	153 (50.8)	81 (49.7)	72 (52.2)	4.7	.32

Data are expressed as mean (standard deviation), unless otherwise specified.

post-surgery. Scores greater than 0 indicate improvement in pain and function. Scores below 0 indicate an increase in pain and function.

A series of linear regression analyses were performed following the steps of Baron and Kenny [45]. The relationship between physicians' pre-operative expectations and hip and knee patients' change in pain and function, and extent of fulfillment of expectations on all time points post-surgery were examined. Additionally, a possible mediated effect of hip and knee patients' pre-operative expectations was examined. Step 1: regression of change in pain and function and fulfilled expectations on physicians' pre-operative expectations. Step 2: regression of patients' pre-operative expectations on physicians' pre-operative expectations. Step 3: regression of change in pain and function, and fulfilled expectations on patients' pre-operative expectations. Step 4: regression of change in pain and function, and fulfilled expectations on physicians' and patients' pre-operative expectations. Mediation was supported when the effect of physicians' pre-operative expectations on change in pain and function, and fulfilled expectations remained significant when controlling for patients' pre-operative expectations.

## Results

Demographic characteristics, expectation scores, and clinical values can be found in Tables 1–3. Mean age of 236 patients was 70 years ( $\pm 7.9$ ) and 60% of patients were female. More hip (N = 205; ie, 52%) than knee patients (N = 190; ie, 48%) were included in the study. Hip and knee patients did not significantly differ on age, gender, employment status, and sports.

### Relationship Between Patients' and Physicians' Pre-Operative Expectations

Physicians' pre-operative expectations were positively related to patients' pre-operative expectations. The higher the physician's pre-operative expectations, the higher the hip ( $b = 0.31$ ,  $t(98) =$

3.09,  $P = .003$ ) and knee patients' ( $b = 0.27$ ,  $t(88) = 6.1$ ,  $P = .02$ ) expectations (Figs. 1–3).

### Relationship Between Pre-Operative Expectations and Extent of Fulfillment of Expectations

Both hip and knee patients' pre-operative expectations were negatively related to the extent of fulfillment of expectations 5 weeks post-surgery (respectively:  $b = -0.37$ ,  $t(123) = -4.4$ ,  $P \leq .001$  and  $b = -0.31$ ,  $t(106) = -3.3$ ,  $P \leq .001$ ), 3 months post-surgery (respectively:  $b = -0.34$ ,  $t(83) = -3.3$ ,  $P = .002$  and  $b = -0.32$ ,  $t(71) = -2.9$ ,  $P = .005$ ), and 6 months post-surgery (respectively:  $b = -0.33$ ,  $t(124) = -3.9$ ,  $P \leq .001$  and  $b = -0.32$ ,  $t(105) = -2.9$ ,  $P = .004$ ) (Fig. 1). Physicians' pre-operative expectations were not related to the extent of fulfillment of hip and knee patients' expectations.

### Relationship Between Pre-Operative Expectations and Pain

Physicians' pre-operative expectations were not associated with hip patients' change in pain (Fig. 2). Yet, hip patients' pre-operative expectations were positively correlated with improvement in pain from baseline to 5 weeks post-surgery ( $b = 0.39$ ,  $t(120) = 4.7$ ,  $P \leq .001$ ), 3 months post-surgery ( $b = 0.41$ ,  $t(83) = 4.0$ ,  $P \leq .001$ ), and 6 months post-surgery ( $b = 0.38$ ,  $t(125) = 4.5$ ,  $P \leq .001$ ).

Physicians' expectations were positively related to improvement in pain at 6 months post-surgery, in knee patients ( $b = 0.39$ ,  $t(71) = 3.6$ ,  $P \leq .001$ ) (Fig. 2). Moreover, physicians' expectations were more strongly related to improvement in pain than knee patients' pre-operative expectations ( $b = 0.22$ ,  $t(102) = 2.2$ ,  $P = .03$ ). After adding knee patients' expectations, physicians' expectations ( $b = 0.36$ ,  $t(69) = 3.3$ ,  $P \leq .001$ ) remained significantly positive associated with improvement in pain 6 months post-surgery. A partial mediation effect of patients' pre-operative expectations on the relationship between physicians' expectations and change in pain was found.

**Table 2**  
Expectations of Hip and Knee Patients.

Mean (SD)	Combined (N = 396)	Hip (N = 205)	Knee (N = 190)	Hip vs Knee	
				$t/\chi^2$	P Value
Patients' expectations					
Post-consultation	67.2 (19.7)	69.5 (20.4)	64.6 (18.6)	2.3	.03
Fulfillment of patients' expectations					
5 wk post-surgery	65.6 (30.1)	73.0 (29.3)	57.1 (28.8)	4.2	$\leq .001$
3 mo post-surgery	82.8 (20.7)	87.6 (19.6)	77.3 (20.8)	3.2	$\leq .01$
6 mo post-surgery	87.1 (18.1)	90.7 (14.4)	82.9 (21.1)	3.3	$\leq .001$
Physicians' expectations					
Post-consultation	65.3 (18.6)	68.3 (20.5)	62.2 (15.9)	2.7	$\leq .01$

Expectation scores could range from 0% to 100%, with higher values indicating more and higher level of (fulfilled) expectations. Data are expressed as mean (standard deviation).

**Table 3**  
Clinical Characteristics of Hip and Knee Patients.

Mean (SD)	Combined (N = 396)	Hip (N = 205)	Knee (N = 190)	Hip vs Knee	
				$t/\chi^2$	P Value
Pain					
Post-consultation	46.4 (19.8)	48.1 (20.7)	44.4 (18.8)	1.4	.17
5 wk post-surgery	72.4 (21.6)	79.8 (18.5)	64.0 (21.6)	6.7	≤.001
3 mo post-surgery	78.9 (18.9)	83.4 (15.7)	73.6 (15.6)	3.9	≤.001
6 mo post-surgery	82.6 (18.8)	85.2 (17.1)	79.7 (20.2)	2.6	≤.01
Function					
Post-consultation	44.1 (20.4)	44.1 (20.6)	44.4 (20.2)	0.1	.88
5 wk post-surgery	65.7 (19.4)	69.1 (19.2)	73.4 (20.9)	2.7	≤.01
3 mo post-surgery	75.4 (15.7)	77.2 (14.8)	73.1 (16.5)	1.8	.08
6 mo post-surgery	78.6 (18.3)	81.0 (16.8)	76.2 (19.6)	1.8	.07

Lower scores on pain and function indicate more extreme problems. Data are expressed as mean (standard deviation).

### Relationship Between Pre-Operative Expectations and Function

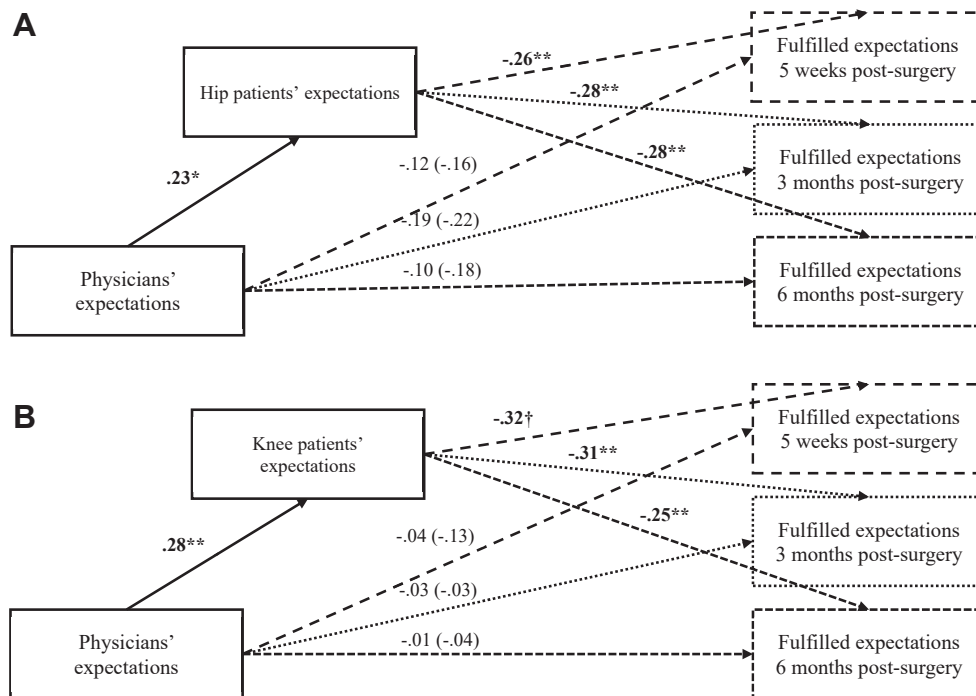
Physicians' pre-operative expectations were not associated with improvement in function in hip patients (Fig. 3). Nevertheless, hip patients' pre-operative expectations were related to improvement in function at 5 weeks post-surgery ( $b = 0.28$ ,  $t(88) = 2.7$ ,  $P \leq .01$ ), 3 months post-surgery ( $b = 0.26$ ,  $t(81) = 2.4$ ,  $P = .02$ ), and 6 months post-surgery ( $b = 0.36$ ,  $t(106) = 3.9$ ,  $P \leq .001$ ).

Physicians' pre-operative expectations were significantly positively related to improvement in function in knee patients, 5 weeks post-surgery ( $b = 0.32$ ,  $t(51) = 2.4$ ,  $P = .018$ ) and 6 months post-surgery ( $b = 0.37$ ,  $t(63) = 3.2$ ,  $P = .002$ ). Nevertheless, knee patients' pre-operative expectations were only related to improvement in function 6 months post-surgery ( $b = 0.27$ ,  $t(92) = 2.6$ ,  $P \leq .01$ ). However, physicians' expectations were more highly associated with change in function at this time point than patients'

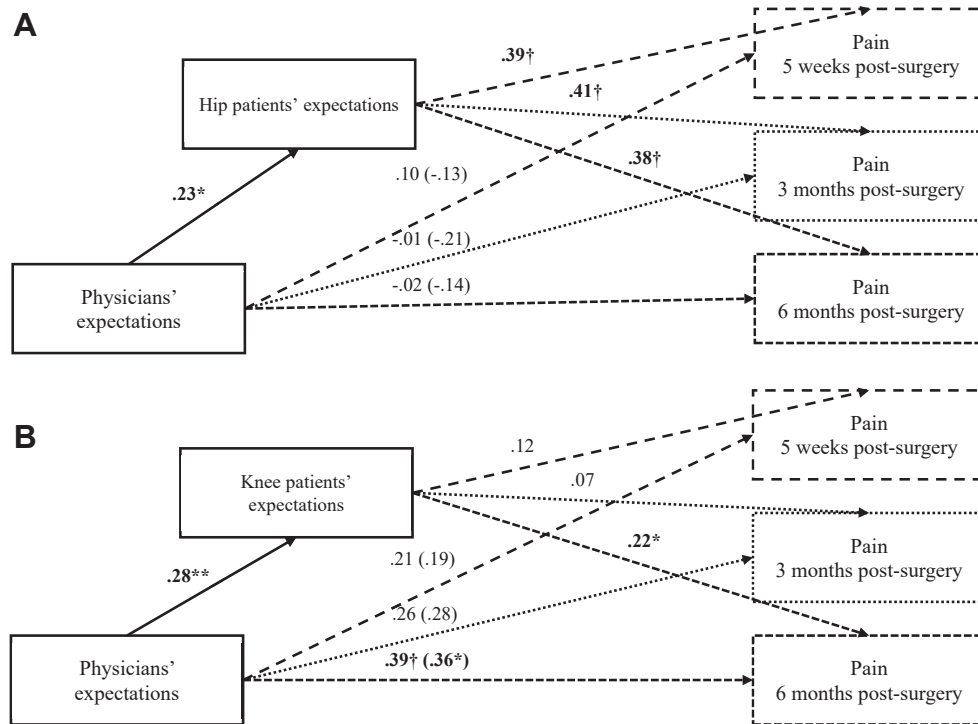
expectations. After adding knee patients' expectations ( $b = 0.26$ ,  $t(60) = 3.0$ ,  $P = .004$ ), physicians' expectations ( $b = 0.35$ ,  $t(60) = 3.0$ ,  $P = .004$ ) remained significantly associated with improvement in function 6 months post-surgery. A partial mediation effect of patients' pre-operative expectations on the relationship between physicians' expectations and change in function was found.

### Discussion

This prospective study examined whether patients' and physicians' expectations were related to treatment outcomes after TKA and THA. Patients' expectations were positively related to objective outcomes and negatively related to subjective outcomes after TKA and THA. Physicians' expectations were only positively associated with objective improvement in knee patients. A partial mediation effect of knee patients' expectations on the relationship between



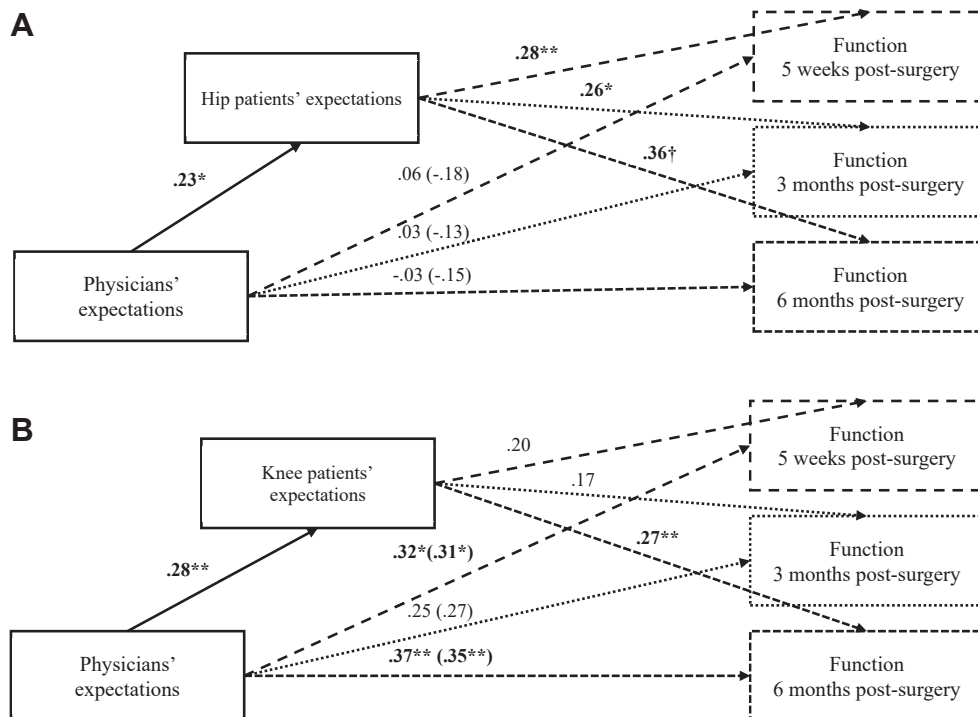
**Fig. 1.** Standardized regression coefficients for the relationship between physicians' pre-operative expectations and hip (A) or knee (B) fulfilled expectations 5 weeks, 3 months, and 6 months post-surgery, mediated by patients' pre-operative expectations. The standardized regression coefficient for the relationship between physicians' pre-operative expectations and fulfilled expectations, controlled for patients' pre-operative expectations, is in parentheses. \* $P \leq .05$ , \*\* $P \leq .01$ , † $P \leq .001$ .



**Fig. 2.** Standardized regression coefficients for the relationship between physicians' pre-operative expectations and hip (A) or knee (B) pain 5 weeks, 3 months, and 6 months post-surgery, mediated by patients' pre-operative expectations. The standardized regression coefficient for the relationship between physicians' pre-operative expectations and pain, controlled for patients' pre-operative expectations, is in parentheses. \* $P \leq .05$ , \*\* $P \leq .01$ , † $P \leq .001$ .

physicians' expectations and objective outcomes was found at 6 months post-surgery. Physicians' expectations positively correlate with knee patients' expectations and are thereby able to relate to a positive change in function.

Physicians' expectations relate to the amount and level of patients' expectations. Within our study, it was found that the higher the expectations of the physician, the higher the patient's expectations. Moreover, the reverse is also true: the lower the physician's



**Fig. 3.** Standardized regression coefficients for the relationship between physicians' pre-operative expectations and hip (A) or knee (B) function 5 weeks, 3 months, and 6 months post-surgery, mediated by patients' pre-operative expectations. The standardized regression coefficient for the relationship between physicians' pre-operative expectations and function, controlled for patients' pre-operative expectations, is in parentheses. \* $P \leq .05$ , \*\* $P \leq .01$ , † $P \leq .001$ .



expectations, the lower the patients' expectations. Patients' expectations are thought to, at least partly, derive from the interaction with the physician [46–49]. Physicians can therefore play an important role in refraining to optimistic patients' expectations [12,15,50].

Patients' expectations were both related to objective and subjective outcomes. Regarding objective outcomes, it was found that patients' pre-operative expectations were positively related to improvement in pain and function at all time points in hip patients, but only at 6 months post-surgery in knee patients. Hip patients often show more and faster improvement in function and pain than knee patients [25–31]. Hip patients' expectations could therefore be related to advantageous outcomes in an earlier stage of recovery than knee patients' expectations. This could explain the absence of a significant association between expectations and outcomes before 6 months post-surgery, in knee patients. Perhaps, the notion that patients have achieved the most clinical improvement at 6 months post-surgery [32–37] is more true for hip than for knee patients [25–31].

Regarding subjective outcomes, pre-operative expectations were related to the extent of fulfillment of expectations, at all time points. However, counterintuitively, given the positive relationship between expectations and pain and function, the association between expectations and the extent of fulfilled expectations was a negative association. The higher the patients' pre-operative expectations, the lesser the extent of fulfillment of expectations post-surgery. Even though high expectations could relate to improvement in pain and function, expectations of patients are still not met. This indicates that the improvement in pain and function was less than patients expected. This fits the assumption that patients usually have too optimistic expectations, which might not be met, despite the ability of patients' expectations to influence non-specific treatment effects [51–55]. A lack of balance between expectations and fulfilled expectations might then result in dissatisfaction [54,56–58].

Physicians' expectations were only associated with objective outcomes in knee patients and not in hip patients in our study. Moreover, a partial mediation effect was found on knee patients' expectations on the relationship between physicians' expectations and improvement in pain and function. In contrast, previous findings showed that physicians often were better in predicting outcomes in THA patients than TKA patients [15,18]. It could be that knee patients as compared to hip patients are more susceptible to the non-specific treatment effect of physicians' and patients' expectations, so that low expectations of the physician may actually result in low outcomes in knee patients [59,60]. In fact, previous research denoted that the placebo effect was greater when prognosis was worse and expected outcomes were lower [59]. As knee patients generally obtain lower outcomes than hip patients [25–31], future research should examine the (difference in) extent of non-specific treatment effects in both hip and knee patients.

The first limitation of our study is the fact that only outcomes reported by patients, and not by physicians, were assessed. Although patient-reported outcomes have become increasingly important in determining treatment success [61–63], there usually is a large difference between outcomes reported by patients and physicians [19,20,40,64,65]. Future research could therefore examine how physicians' and patients' expectations relate to outcomes reported by physicians (ie, outcomes from a clinical point of view). Another limitation concerns the follow-up period of our sample. Although it was found that the average patient has achieved the most clinical improvement at 6 months post-surgery [32–37], some patients, especially knee patients, continue to report improved outcomes up to many years post-surgery [34,35,66,67]. Therefore, future studies should examine the relationship between

(fulfilled) expectations and outcomes over a larger period of time. Other limitations relate to the study design of our study, which is an observational study with a subsample of a larger cohort. Therefore, possible selection bias could not be ruled out.

In clinical practice, physicians should inform patients what to expect in order to be able to achieve optimal outcomes. Emphasis should particularly be placed on patients with unrealistically high expectations, as a lack of achievable balance between what is expected and achieved could result in dissatisfaction [56]. Attention should thereby especially be drawn to TKA patients, who often have high expectations, show slower improvement, and achieve sub-optimal outcomes [25–31]. Moreover, the focus should also be at patients with low expectations, as they might not be motivated to bring the best out of themselves and might therefore be at risk of insufficient recovery [68,69].

To conclude, it was found that patients' high expectations were associated with better objective outcomes. However, high expectations in both hip and knee patients also resulted in unfulfilled expectations, which indicate that improvement in pain and function was still less than patients expected. Physicians' expectations were associated with patients' expectations, and with better outcomes in knee patients.

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